

CLAIMS

What is claimed is:

1. A method of synthesizing a double metal cyanide (DMC) catalyst, said method comprising the step of:

5 combining a non-aqueous solution of a first metal salt of the general formula $M(X)_n$ wherein;

M is selected from the group consisting of aluminum, zinc, and the transition metals,

10 X is an anion selected from the group consisting of halides, hydroxides, sulfates, carbonates, cyanides, oxalates, thiocyanates, isocyanates, isothiocyanates, carboxylates, and nitrates, and

n is a value from 1 to 3 satisfying the valency state of M;

with a non-aqueous solution of a second metal salt of the general formula $N(Y)_n$ wherein;

15 N is selected from the group consisting of the transition metals and the lanthanides,

Y is an anion selected from the group consisting of halides, hydroxides, sulfates, carbonates, cyanides, oxalates, thiocyanates, isocyanates, isothiocyanates, carboxylates, and nitrates, and

20 n is a value from 1 to 3 satisfying the valency state of N; and

with a non-aqueous solution of an alkali metal cyanide in a single step to synthesize the DMC catalyst.

2. A method as set forth in claim 1 wherein the non-aqueous solutions of the first metal salt, the second metal salt, and the alkali metal cyanide comprise the first metal salt, the 25 second metal salt, and the alkali metal cyanide, respectively, dissolved in a non-aqueous

solvent selected from the group of polar protic solvents, dipolar aprotic solvents, and combinations thereof.

3. A method as set forth in claim 2 wherein the polar protic solvents are selected from the group consisting of alkanols, carboxylic acids, and combinations thereof.

5 4. A method as set forth in claim 3 wherein the alkanols are selected from the group consisting of methanol, ethanol, propanols, butanols, and combinations thereof.

5. A method as set forth in claim 2 wherein the dipolar aprotic solvents are selected from the group consisting of ketones, alkyl acetates, nitriles, formamides, sulfoxides, N-alkylpyrrolidinones, and combinations thereof.

10 6. A method as set forth in claim 1 wherein the non-aqueous solutions of the first metal salt, the second metal salt, and the alkali metal cyanide comprise the first metal salt, the second metal salt, and the alkali metal cyanide, respectively, dissolved in methanol.

7. A method as set forth in 1 wherein the alkali metal cyanide is selected from the group consisting of KCN, LiCN, and NaCN.

15 8. A method as set forth in claim 1 wherein the step of combining is further defined by first combining the non-aqueous solution of $M(X)_n$ with the non-aqueous solution of $N(Y)_n$ to establish a first non-aqueous solution.

9. A method as set forth in claim 8 wherein the step of combining is further defined by combining the first non-aqueous solution with the non-aqueous solution of the
20 alkali metal cyanide.

10. A method as set forth in claim 1 wherein the step of combining forms a suspension having a continuous phase and a particle phase dispersed throughout the continuous phase wherein the particle phase comprises the DMC catalyst synthesized from the combination of the non-aqueous solutions of the first metal salt, the second metal salt, and
25 the alkali metal cyanide, and the continuous phase comprises a secondary product.

11. A method as set forth in claim 10 further comprising the step of separating the particle phase from the continuous phase.

12. A method as set forth in claim 11 wherein the step of separating the particle phase from the continuous phase comprises the step of filtering the suspension to collect the particle phase comprising the DMC catalyst as a retentate.

13. A method as set forth in claim 12 wherein the step of separating the particle phase from the continuous phase further comprises the step of drying the retentate.

14. A method as set forth in claim 11 wherein the step of separating the particle phase from the continuous phase comprises the step of holding the suspension until the particle phase at least partially separates from the continuous phase.

15. A method as set forth in claim 14 wherein the step of separating the particle phase from the continuous phase further comprises the step of decanting the continuous phase after the suspension has been held.

16. A method as set forth in claim 1 wherein the first metal salt is combined in molar excess relative to the second metal salt.

17. A method as set forth in claim 1 wherein the non-aqueous solutions of the first metal salt, the second metal salt, and the alkali metal cyanide each include from 0.1 to 50 parts by weight of the first metal salt, the second metal salt, and the alkali metal cyanide, respectively, based on 100 parts by weight of the non-aqueous solution.

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18. A method of synthesizing a double metal cyanide (DMC) catalyst, said method comprising the step of:

combining a non-aqueous solution of a first metal salt of the general formula $M(X)_n$ wherein;

5 M is selected from the group consisting of Al(III) and Zn(II),

X is an anion selected from the group consisting of halides and acetate, and

n is a value from 1 to 3 satisfying the valency state of M;

with a non-aqueous solution of a second metal salt of the general formula $N(Y)_n$ wherein;

10 N is selected from the group consisting of the Fe(II), Fe(III), Co(II), Co(III), and Nd(III),

Y is an anion selected from the group consisting of halides, and

n is a value from 1 to 3 satisfying the valency state of N; and

15 with a non-aqueous solution of an alkali metal cyanide in a single step to synthesize the DMC catalyst.

19. A method as set forth in claim 18 wherein the non-aqueous solutions of the first metal salt, the second metal salt, and the alkali metal cyanide comprise the first metal salt, the second metal salt, and the alkali metal cyanide, respectively, dissolved in a non-aqueous solvent selected from the group of polar protic solvents, dipolar aprotic solvents, and
20 combinations thereof.

20. A method as set forth in claim 19 wherein the polar protic solvents are selected from the group consisting of alkanols, carboxylic acids, and combinations thereof.

21. A method as set forth in claim 20 wherein the alkanols are selected from the group consisting of methanol, ethanol, propanols, butanols, and combinations thereof.

22. A method as set forth in claim 19 wherein the dipolar aprotic solvents are selected from the group consisting of ketones, alkyl acetates, nitriles, formamides, sulfoxides, N-alkylpyrrolidinones, and combinations thereof.

23. A method as set forth in claim 18 wherein the non-aqueous solutions of the first metal salt, the second metal salt, and the alkali metal cyanide comprise the first metal salt, the second metal salt, and the alkali metal cyanide, respectively, dissolved in methanol.

24. A method as set forth in 18 wherein the alkali metal cyanide is selected from the group consisting of KCN, LiCN, and NaCN.

25. A method as set forth in claim 18 wherein the step of combining forms a suspension having a continuous phase and a particle phase dispersed throughout the continuous phase wherein the particle phase comprises the DMC catalyst synthesized from the combination of the non-aqueous solutions of the first metal salt, the second metal salt, and the alkali metal cyanide, and the continuous phase comprises a secondary product.

26. A method as set forth in claim 25 further comprising the step of separating the particle phase from the continuous phase.

27. A method as set forth in claim 26 wherein the step of separating the particle phase from the continuous phase comprises the step of filtering the suspension to collect the particle phase comprising the DMC catalyst as a retentate.

28. A method of synthesizing a double metal cyanide (DMC) catalyst, said method comprising the step of:

combining a non-aqueous solution of ZnI_2 ;

with a non-aqueous solution of CoCl_2 ; and

5 with a non-aqueous solution of KCN in a single step to synthesize the DMC catalyst.

29. A method as set forth in claim 28 wherein the non-aqueous solutions of ZnI_2 , CoCl_2 , and KCN comprise ZnI_2 , CoCl_2 , and KCN, respectively, dissolved in a non-aqueous solvent selected from the group of polar protic solvents, dipolar aprotic solvents, and combinations thereof.

10 30. A method as set forth in claim 29 wherein the non-aqueous solvent is methanol.

31. A method of synthesizing a double metal cyanide (DMC) catalyst, said method comprising the step of:

combining a non-aqueous solution of ZnBr_2 ;

with a non-aqueous solution of CoBr_2 ; and

5 with a non-aqueous solution of NaCN in a single step to synthesize the DMC catalyst.

32. A method as set forth in claim 31 wherein the non-aqueous solutions of ZnBr_2 , CoBr_2 , and NaCN comprise ZnBr_2 , CoBr_2 , and NaCN , respectively, dissolved in a non-aqueous solvent selected from the group of polar protic solvents, dipolar aprotic solvents, and combinations thereof.

10 33. A method as set forth in claim 32 wherein the non-aqueous solvent is methanol.